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Inter-annual variation of runoff and soil loss in Europe and the Mediterranean in relation to land use and climate.

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Experimental assessment of annual runoff (R) and soil loss (SL) by sheet and rill erosion is often obtained from runoff plots with a limited measuring period and the data are often summarized as the average annual R and SL for that measuring period. Likewise, erosion models like RUSLE and PESERA also predict the mean long-term SL. For many applications such as the design of soil and water conservation measures, it is not only necessary to estimate the mean long-term R and SL, but also the maximum R and SL that may occur. While most individual studies provide an estimate of the annual variation in R and SL, the limited number of plots and measurement years for each of these studies separately does not allow to draw general conclusions about temporal variability of R and SL. So far, also modelling efforts to quantify SL for Europe have not considered the annual variation of R and SL data.

Therefore, the objectives of this study are to quantify the inter-annual variation of R and SL measured on runoff plots throughout Europe and the Mediterranean. Secondly, it is explored whether the annual variation of R and SL is related to climatic conditions and/or land use on the plot.
R and SL data for which a minimum of 7 consecutive years of R and/or SL measurements was available were selected from a runoff plot database for Europe and the Mediterranean region, recently compiled within the framework of the DESIRE project (EU-FP6). This resulted in a dataset of 175 time series, with a total of 2 434 plot-years from 43 measuring sites throughout Europe and the Mediterranean. It was shown that the majority of these time series are not normally distributed and right-tailed, with maximum values within time series being up to 60 times larger than median values for R and up to 150 times for SL. Hence, the use of statistical variables derived from the normal distribution (e.g. mean or standard deviation) are of limited use when describing R and SL time series. Furthermore, it was demonstrated that the magnitude of temporal variability of R and SL decreases with increasing magnitude of the median R and SL in the time series. With respect to climate, inter-annual R and SL variability first increases, then reaches a maximum and finally decreases with increasing annual precipitation. No clear trends in temporal variability of R and SL were found between different land uses, and the observed differences between land uses are likely caused by the above-mentioned factors.

keywords: temporal variation, runoff, soil loss, erosion plots, land use, climate